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OBSERVATIONS ON THE DENUDATION OF VEGETATION—A SUGGESTED REMEDY FOR CALIFORNIA.

BY MARSDEN MANSON, C. E., PH. D.

When man, actuated by greed or ignorance, or a combination of the two, destroys the protection which nature spreads over rolling and mountain areas, he turns loose agencies which soon pass beyond his control. The protecting agent is vegetation, and whether in the form of forests, brush, or forage plants and grasses, the balance between it and denuding forces is easily tipped, when the inexorable law of gravity unchecked by myriad blades of grass, by leaves, roots, and vegetable mold, gullies the hillside, strips the mountain slope, converts the rivulet into the torrent, and causes the steady flow of the river to become alternately a devastating flood or a parched sand-bed. When once this balance has been destroyed, man cannot turn back the torrent and bid it flow once more a living and life-giving stream.

It would seem that this lesson had been learned so thoroughly by the human race that there would be little use to lay its precepts before a civilized community. But when one goes out over this fair land of ours and marks the rate at which its forests are being destroyed, its mountain forage areas devasted, he is tempted to regret that civiliza-

tion should be permitted to spread its blight over the temples in which the savage worshiped.

But it must be remembered that this destruction ceases in the judicious use of this wealth of forest and of mountain pasture, and that it is only indifference and incivism which permits greed and ignorance to go unrestrained until they destroy the balance,—that man has it within his power to utilize to its fullest measure this wealth and to pass it down to future generations as a blessing, rather than as a blight and a curse,—and that he can even aid nature by extending vegetation over barren areas. But this requires that the reckless destruction of forest, and the wasteful and continuous devastation of pasture should be replaced by systematic utilization of these sources of wealth.

A Few Instances of the Effects of Denudation.

In several ranges of mountains and over considerable portions of California the writer has had opportunities to observe the effects of denudation.

Probably no range of mountains has longer had civilized man around its base than the great Caucasus and its outliers. This range extends from the Straits of Kertch to the Caspian Sea, a distance of over nine hundred miles. The culminating peak, Mount Elbruz, rises some three thousand feet higher than the highest peaks in the United States, and the group is analagous to but greater in all respects than the Sierra Nevada. Its slopes drain either into the Caspian Sea or into the Black Sea and the Sea of Azov. The slope draining into the Black Sea is subject to summer rains, and therefore more readily recovers from denuding agencies. The southern slope is broader and gentler than the northern, which is subject to a drier climate, and sparsely covered with both deciduous and coniferous growths. At all points where these mountains were observed man has wrought ruin since the dawn of history. Every stream, every slope is marked

UPPER REGION OF THE TIREK AND NORTH SLOPE OF THE CAUCASUS.

LOWER PORTION OF THE ARANGUA—RIVER BED BURIED.

with destruction. The great historic route up the Tirek, through Darial Pass, and down the Gudoor and Arangua to the plains of Asia Minor, is everywhere seamed with the ruin which the unrestrained hand of man has put in force.

In passing along the main drainage lines, it is possible with a little experience to determine the comparative exposure of the tributary watersheds by the amounts of debris brought down. The appended photographs show the general appearance of the slopes and streams, the measures taken to restrain and divert the flow of debris from the roads, and to provide crossings where roads are buried and bridges swept out. Nothing which man can call to his aid can restore soil to these wasted slopes. Such is the penalty of unrestrained stripping of timber and forage plants.

In parts of Europe the destruction has been as great; the literature on this subject is both voluminous and accessible. Enormous efforts have been put forth by the European governments to check the destructive force of torrents born upon the denuded slopes of the great chains of mountains throughout the continent. In no instance have these efforts been adequate, although much has been accomplished. Of the deserts of Southern France, S. Baring-Gould writes that "One hundred years has sufficed to sweep every particle of soil from the Causses, which it took countless ages to accumulate; and land that once maintained a well-to-do population is reduced to a desert." *

The plateaux of Central Spain and the south slope of the Pyrenees afford the best comparisons with our conditions in California — the climate and rainfall being in general analogous to ours, and the poverty and desert-like conditions warn us as to our future, should our course of timber destruction and unrestrained pasturage continue. The descendants of the shepherds who devastated the fair land of Isabella

* *Deserts of Southern France.* Vol. I, p. 23.

are in many instances found at the same work in our mountain pastures, equally disregarding the laws of nature.

In the Rocky Mountains, the work of devastation has been inaugurated on a scale calculated to dwarf anything done in Europe. Forest fires, the crowding of vast herds of sheep, the ax of the lumberman, followed by the fires of the sheep-herder, have all been active agents in converting vast areas into deserts as barren as those of the Causses, the Atlas, or the Apennines. In portions of the Rocky Mountains trees spring up rapidly after the first forest fires. Even when these fires have been so fierce as to absolutely destroy every vestige of timber, a second forest springs up with remarkable promptness and vigor; but when this is destroyed the next attempt of natural forces to restore vegetation is slower, and not effective. The appended photograph shows the second year of absolute barrenness in the midst of summer. The areas had been twice swept by forest fires. The first, burning off the original timber; the second, following a few years later, killing the sapling firs and pines. Although two summers had elapsed, not a sprig of vegetation has started to clothe for the third time the naked rocky "backbone of our continent."

The Sierra Nevada has fared even worse. Around Lake Tahoe the timbered areas have been entirely swept off, with the exception of a few thousand acres around Tallac, and some at the north end, reserved by the owners for later use. The mountain sides around the Hot Springs, and nearly all of the moraines and flats around the south and east sides of the lake, have been denuded. These areas, bereft of timber, are now ready to be abandoned to the State, large tracts being for sale at fifty cents per acre. The railroads, which were constructed to carry logs to the lake, have been torn up, and the region, shorn of its wealth and beauty, has been partly burned over to give a few sprouts to hungry hordes of sheep.

NEAR SUMMIT OF ROCKY MOUNTAINS, WYOMING.
(Twice burned over.)

TRACK OF TORRENT BELOW BURNED-OVER FOREST, SIERRA NEVADA.

On the forks of Carson River there are several townships from which every vestige of timber has been stripped, first for mine timbers and later for wood. Then the area was burned over to afford tender shoots for spring pasturage. To-day it is only in rare little patches that young conifers are beginning to gain a foothold, and fires destroy many of these plantations. On the east fork in 1896, after heavy summer showers, the water sluiced off the ashes and soil to such an extent that tons of trout were killed. After the torrent subsided one could drive a four-horse wagon along the banks and load it with the dead trout. It is doubtful whether the stream can be restocked until the denuded slopes shall be afforested.

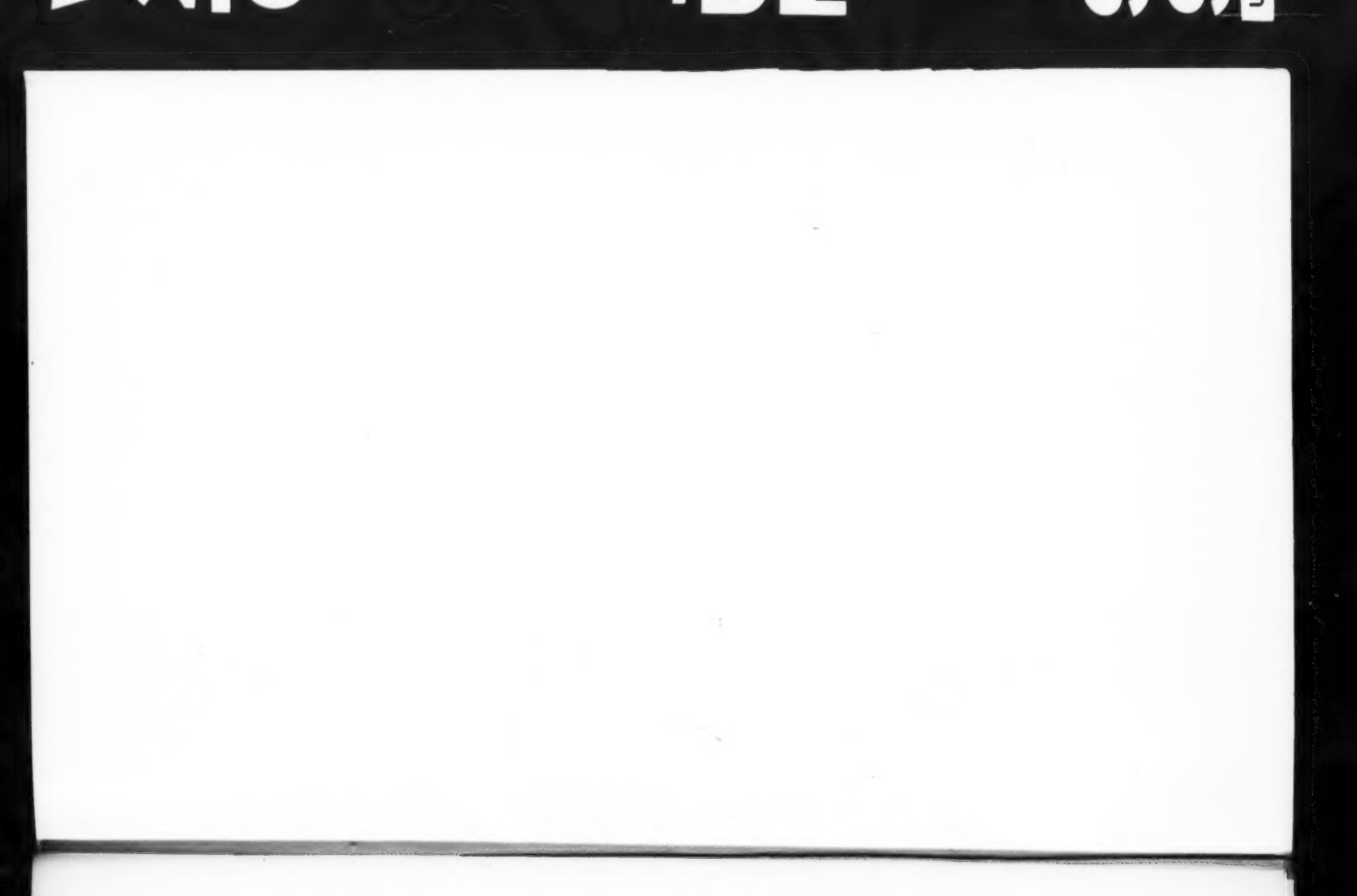
It is only necessary to read the accounts given in the daily press to partly measure the destruction by forest fires. The writer has personally traced these through every mountain county in the State. Even of that area which has been sacredly set aside as the Yosemite Reservation, the threat was openly made by the maurading sheep-herders, who have devastated Spain and Portugal, that they "would burn the Government out," — referring to the cavalry sent up to prevent the illegal destruction of the vegetation protecting the head-waters of the Merced and Tuolumne. The overstocking of these mountain pastures is what is doing the greatest harm. The writer once asked an intelligent stockman how many sheep could be pastured on a given area in the Sierras, and he gave, as his opinion, that 8,000 sheep could be pastured thereon without injury,— that is, without destroying all seed of forage plants and grasses. But, upon naming over the owners and herds which he knew, there were 40,000 sheep accounted for in the area.

The photograph opposite was taken in the drainage basin of the Moquelumne. It shows the path of a so-called "cloudburst." This was nothing more than a heavy summer rain upon a burned-over district, concentrating rapidly

in the steep gulches, and finally scouring away timber, bowlders, and earth. In traveling thousands of miles in various ranges of mountains, on three continents, the writer has never seen the track of a cloudburst in a timbered country — always in the barren ranges from which timber was either naturally absent or had been destroyed by human agency. The reasons for this are twofold: First — Heavy rainfall occurring in a well-timbered country is absorbed, even when the fall amounts to several inches in a short space of time. In a barren region this absorption does not take place; the rain rapidly collects in gulches, and forms, in some instances, a veritable wall of water, soil, gravel, and rocks, carrying everything before it.

Second — The layers of cold, dry air, and hot, moist air, can superimpose themselves in a treeless country in such a manner that when condensation is inaugurated it takes place with destructive violence. These conditions are modified, or even entirely prevented, by the effects of forests and vegetation; and hence those regions escape the most violent downpours. The rainfall in tropical regions is several times greater than any occurring upon the treeless regions subject to "cloudbursts," yet the destructive run-off from tropical forest areas does not occur, on account of the dense forests and undergrowth.

The Coast Range in Lake County presents some of the worst of the early stages of denudation. The herding of sheep has been so close and continuous, that the forage plants and grasses have nearly disappeared. Over large areas it is now difficult, if not impossible, to find a single specimen of a once abundant forage flora. Many acres of valley land are being washed away; the beds of streams are widening by cutting away alluvial deposits of past ages and leaving bars of cobbles and gravel in their stead. These evidences of rapid deterioration are characteristic of all the public and much of the private land in the county.



SHOWING PORTION OF DENUDED AREA IN LOS GATOS CREEK.
(One million dollars' worth of land destroyed.)

This is the price which has been paid for the reckless use of the wealth with which that county was endowed; and the little benefit gained has accrued, in many instances, to herders or owners of sheep who owned no part of the lands upon which the damage is being inflicted. This county has been abused to such an extent that it is doubtful whether all the wealth which has been made upon wool and mutton in the entire State since 1849 could restore this single county to its pristine condition. Nor is this state of affairs confined to Lake county,—it extends throughout the State. If unheeded for a generation more, it will not be within the power of the human race to stay the destructive forces which have thus been turned loose, and to restore to our mountains their reservoirs of wealth and of water. Yet, under systematic and intelligent control, these areas may still be made the sources of perennial and increasing wealth, and the reservoirs from which the mining and agricultural lands below may draw never-failing supplies of water.

In Santa Clara County the floods of Los Gatos Creek have measurably increased in destructiveness. In one of the richest portions of the valley more than one million dollars' worth of land has been recently destroyed. The photograph shows a portion of this destruction and the feeble efforts of the adjacent land-owners to stay the force of the torrential floods which, with increasing volumes, are eating away the alluvial lands, leaving in their stead the "barranca" forms of Southern and Lower California.

In the lower reaches of the Santa Ana, many hundreds of acres of valuable soil are being buried under wastes of sand brought down from the burned-over sheep pastures of the mountain watershed. These instances could be multiplied almost indefinitely from every portion of the State. But the real damage has so far only commenced. The most appalling feature is the absolute indifference with which the

mass of the people and the law-makers of our country regard the ultimate consequences of the forces at work.

Effect of Vegetation In Storing Water.

But few give full credit and consideration to the effect which vegetation has in checking the rate of run-off and aiding in the storage of water. This effect is vital, both to the preservation of springs and streams and to artesian supply, and preserves and supplements artificial storage.

In a catchment area of five hundred acres to one acre of reservoir space below, each foot of depth of reservoir capacity is equaled by an effective storage capacity of soil of less than one fortieth of an inch, so that if by reason of covering the catchment area with vegetation, one fortieth of an inch of rainfall can be caught beneath the surface and let down slowly to dependent springs and streams, this fraction is the equivalent of an acre covered one foot deep; or one inch of moisture stored in the soil is equivalent to forty feet of water in the reservoir.

In many forests in California, it takes more than five inches of rainfall in the autumn to give an appreciable increase of run-off — showing that the forest has checked the rate of run-off to an extent more than 200 times greater than the figure above mentioned as being the equivalent of a foot of water in the reservoir.

The great difference in the storage capacity of a timbered and non-timbered area is plainly shown in the flood capacity of the channels draining each. In the northern coast counties, subject to an annual rainfall of from fifty to sixty inches, the flood channels are of far less capacity than those in the southern coast counties, upon which the annual rainfall is from one fourth to one fifth that in the northern mountain slopes. The run-off from the treeless areas occurs in a few hours — whilst that from the timbered areas is so slow that it is not accomplished in months.

In considering the problems connected with the storage and conservation of water, it is essential to take up that of the storage or sponge capacity of the soil and the means necessary to increase this. Whether reservoir space be available or not, this factor and its possible increase should not be neglected, for a reservoir supplied from a catchment area devoid of protecting vegetation is soon silted up.

To directly trace and determine the effect of an increased rate of run-off upon artesian supply is a difficult and obscure problem. But the broad results are clear. Whether the water seeps into and through permeable strata, or under the edges of impermeable clays along the upper reaches of the valley channels, the result is the same. If the catchment area be denuded of vegetation and soil, a decrease in artesian supply must follow. This is due to the shorter time in which the rainfall can seep into the water-bearing strata — the increased rate of run-off going to swell the volume and destructiveness of floods.

In order to bring these generalizations into practical bearing upon the problems which confront us in California, we will consider the areas set aside as forest reservations and remaining as public domain in California.

Forest reserves approximate 14,000 square miles, as follows:—

	ACRES
Stanislaus Forest Reserve	705,000
Yosemite Forest Reserve	1,009,680
Sierra Forest Reserve	4,079,360
Pine Mountain and Zaca Lake Forest Reserve	1,159,083
San Gabriel Forest Reserve	573,048
San Bernardino Forest Reserve	731,176
San Jacinto Forest Reserve	664,678
Trabuca Cañon Forest Reserve	49,760
Total	8,972,125*

In addition to this, 34,688,932 acres, 54,000 square

* Reports of Surveyor-General of California.

miles,— or about one third the area of the State,*— is yet public land. These two aggregate 68,000 square miles, much of which is classified as desert land, but even this is used many months of each year for pasturage; another large fraction is mountain or rolling land sparsely timbered or covered with brush interspersed with forage plants, which make it of great value for pasture.

The policy of the Government in the control of this vast area has been along one of two lines — absolute neglect or absolute exclusion. After long periods of neglect, spasmodic efforts at protection have been made by sending out a "special agent" from the "East," who generally knows but little of our forests and less of our climatic conditions. Sometimes his efforts have resulted in the institution of suits for "illegal cutting of timber." These have generally resulted in dismissal, or, in rare instances, in the rendering of a judgment amounting to a small percentage of the value of the timber stolen. In some instances, when active and real examinations into the illegal seizing of lands, cutting of timber, or other abuses, have been instituted, the agent has been "recalled."

These efforts have, therefore, never resulted in much good other than to check for a while the fraudulent acquisition of public land, or the stealing of timber therefrom. They have never been the result of a well-conceived and sustained effort to protect the public domain and to conserve the interests and wealth thereof.

In one or two of the reservations, the opposite policy of absolute exclusion has been spasmodically carried out; a force of cavalry has been sent up to patrol the reservations, and under the thorough discipline of army officers, trespassing sheep-herders have been arrested, their flocks scattered, and effective restraint inaugurated over a limited portion of the forest areas.

* Records in office of Surveyor-General.

Neither of these policies is wise. The first condemns itself; the second fails to utilize the vast wealth of forest and pasture which these lands are capable of yielding. It is doubtful whether any system of forest management controlled from Washington, and under an ever-changing political system, could be efficiently and wisely administered. There are great obstacles to be overcome in getting rational conception of the facts before Congress. Eastern members, and even our own, rarely have more than a general idea of the facts, and are adverse to any policy of "withdrawal of the public domain from market" as long as there is land of speculative value left.

Again, the climatic conditions of California differ widely from those of other portions of the United States, and present greater difficulties to forest cultivation by reason of the absence of summer rains. Our forest flora are unique in the world; hence forest management here must be essentially modified from that found advisable elsewhere. It would, therefore, require a local and unique treatment, special in its development, and entirely different from what we must expect from a government which has never undertaken the handling of forest areas in a wise and statesmanlike manner.

The valuable timbered areas have long since passed to the ownership of aggregations of capital or private parties. In the Coast Range, it sometimes happens that one million feet, board measure, of lumber stand upon a single acre; this, at a stumpage of $2.50 per thousand feet, is worth $2,500; yet it has been sold for $2.50. The sugar-pine, redwood, fir, spruce, etc., of the Sierras, have been disposed of in the same way. This is not new in the history of this country. The white pine of Maine, the live-oaks of Florida, the vast pine forests of Michigan and Washington have received the same treatment, and to-day thousands of acres, despoiled of their wealth, their recuperative powers checked by destructive pasturage, and intentional or accidental fires,

are in one or the other stage of decrepitude. The owners of these lands are, in some instances, almost ready to return them to the State. When an attempt is made to check the evil of timber-land-grabbing, pressure is brought to bear on Congress by those who desire to exploit the public wealth, and the attempt is rendered abortive. The results of this system are glaringly set forth in the case of the live-oak forests of Florida. Shortly after Florida was purchased, large reservations of this valuable timber were made for the use of the Navy. Later contractors for furnishing this class of timber to the Navy supplied, at high prices, the timber stolen from these very reserves.*

Nevertheless, under the advice and spur of those interested in forestry, and who realize the evils of forest denudation, broad and important investigations have been made, thorough studies have been carried on, the benefits to follow from correcting the evils which are practiced are fully elucidated, and have been reiterated with convincing force before successive Congresses for the last quarter of a century or more; yet no broadly conceived policy to check forest fires, to stop depredations, nor to afforest barren areas has been put in force; nor has any considerable portion of the funds recovered from timber stolen from the public domain been used to afforest the same; neither is any part of the funds derived from the sale of timbered lands set apart for forest preservation. No broader studies have been made under any government than the advocates of forestry have issued from the Government Printing Office. That these studies have resulted in no practical result is proof of the view that Congress cannot directly manage practical forestry. It is possible that the limit of work which the General Government can do is reached when the examinations are made. It would be idle to cite greater affairs which the Government has successfully accomplished as proof that it

* George P. Marsh: *The Earth as Modified by Human Action*, p. 387, note.

could undertake systematic forestry, for in this the element of "politics" must be dealt with in its most effective form, and the only way to nullify it is to place forestry above and beyond the power of the "practical" politician.

No policy contaminated by political control can be enforced over the long periods of time necessary in successful forest management. There is now on trial in New York the experiment of putting forest preservation in the hands of the State, aided by the broadening influences of a college of forestry. It is probable that the results will be more favorable than any possible under the General Government, for the nearer these great interests are to the people, to the individual, the greater becomes the possibility of beneficial results. The State Government is, however, liable to the same error as is the General Government. The same evils attend both systems. The differences are those of degree only; with readiness of correcting mistakes and evils possibly in favor of State administration. The evils attendant upon State administration of these problems are indicated in the case of the swamp and overflowed lands granted to this State by the "Arkansas Act" of 1850, the history of which is replete with mismanagement and fraud. To insure the most efficient management and the eradication or correction of the present evils with their certain results, a further remove from political influence is necessary than is likely under either mode of control. To some conservative body, constitutionally stable and beyond the reach of political influence, must these vital interests be intrusted. The nearest to this ideal is the Board of Regents of our State University. To their hands is intrusted the more important duty of directing the higher education of the youth of our State, and to them may be intrusted the care of our forests, particularly since the care and extension of forests and the conservation of water afford some of the best means of practically teaching and enforcing the

broadest principles of economics. In the great problems of forest preservation and extension lie some of the grandest applications of science, particularly of that branch of science the object of which is "the utilization of the materials and forces of nature for the benefit of man." The student can find no more comprehensive problems than those connected with replacing and conserving the forests, for these problems vitally affect the ultimate development of every industry of our State, and, under our peculiar climatic conditions, will for the remotest future determine the metes and bounds of the civilization which we are striving to establish.

We have but to ask what has followed the devastation of the forests of Lebanon, of the Caucasus, of the Atlas, of the Apennines, and of the Pyrenees, to answer with certainty the question, what will follow the devastation of the forests of the Coast Range and of the Sierras. History and nature record no law more inflexible, no effect more certain, than that poverty and degradation follow upon the destruction of the mountain forests. Could this lesson be fully impressed upon our youth — upon the statesmen of the future — there is no effort they would not willingly put forth to check the destructive agencies now in force. The revenues which these public lands and reservations can, without damage, be made to yield can be made adequate to inaugurate systematic forestry without calling upon either state or national funds, except sufficient to start the work. It requires the uniting of all interests, and the execution of the plan upon broad lines for the benefit of the great commonwealth, the State of California.

The Remedy Suggested for California.

The writer, therefore, advocates that all forest reservations and public lands upon mountain slopes, within the borders of the State, be granted by Act of Congress to the University of California in trust; that the object of this

trust be: to protect, maintain, develop, and extend the water supply of these areas forever. For this purpose, that the Regents be empowered to lease, under proper control, the timber-cutting and pasturage privileges of these areas, and to use this fund:

1st. To protect the catchment areas.

2d. To maintain a college of practical forestry.

3d. To construct reservoirs at such points as may be necessary to the industries of the State, and dispose of the water for the benefit of the trust.

4th. To acquire mountain lands to be added to the catchment areas.

5th. To do all such things as may maintain wise systems of forest and water conservation and use.

Since the Government has sold the timbered areas, and permitted them to be stripped to the serious injury of our water supply, it may justly be claimed that the least restitution it can make is to set aside the remaining lands for the purpose of restoring and conserving this water supply.

The extent of income-bearing property which can be made available for forest preservation and storage of flood waters is far beyond the general idea. It has been shown that the public lands and reservations within the borders of the State of California are about 68,000 square miles. It would be difficult to determine the value of the pasturage and timber-cutting privileges of this area. The fact that it covers more than one third the area of the State, and that upon it a large portion of the stock raised in this and in the adjoining State of Nevada is annually pastured, is proof that it is of considerable moment. Although public domain, it is used for private purposes in a way that is surely accomplishing a ruin of which we have but an inadequate knowledge. An experienced stockman placed the value of the pasturage privileges of the Yosemite

Reservation at $50,000 for the summer of 1898, and at more than half that sum for ordinary years.

Inyo and Mono counties draw a revenue of from $3,000 to $7,000 per year from a "sheep license" which they levy on intinerant herders who pasture sheep on the public land in those counties.

The Yosemite Reservation is about one forty-fifth (1-45) of the public land and forest reserve areas, and on the above valuations is estimated to be worth at least $25,000 per year for pasturage alone. This probably measures a considerable fraction of the value of the entire area. If this fraction be placed at one tenth (1-10) the gross value of these privileges, it represents a revenue of a quarter of a million dollars per year, or four per cent income on $6,250,000.

It must be borne in mind that this area is now being used by individuals in such a way as not only to devastate it, but to seriously damage the fertile valley lands below the mountain areas, and to threaten cities and farming communities with ever-increasing floods, with the resulting low-water stages of spring and summer. If this policy be continued it will reduce our State to the conditions now prevailing in corresponding latitudes in Spain, Italy, Northern Africa, and Asia Minor. The same forces, the same methods, which have stricken those countries with poverty and degradation are to-day being wantonly and recklessly put in force here. The people of those lands are even now finding congenial employment upon our mountain slopes and are inaugurating the same practices which have reduced the orchards, vineyards, and pastures of their forefathers to uninhabitable wastes.

Thus these vast areas are becoming more and more barren and less and less able to restrain floods, instead of being systematically improved with the ever-increasing revenues which they can be made to yield.

Mining and agricultural interests are now confronted with the necessity of organizing to secure State and Government aid to construct reservoirs, to store flood waters for use during the late summer and autumn, the increasing rate of run-off not leaving sufficient water in the streams to serve their needs. Even if these efforts were at once successful, the construction of reservoirs will not answer future needs. Without forest preservation, these reservoirs will fill up with sand, gravel, and cobble-stones. Thus these reservoirs, if built, will answer the needs of only the immediate future.

The only true solution of the question is to utilize the revenues which the pasturage and timber-cutting privileges of the public domain can be made to yield in protecting the watersheds from denudation and in conserving and storing the water supply; could these revenues be justly expended for this purpose, the areas would be ever-increasing in value and usefulness, and nothing need be asked from the State or from the Government save a sum sufficient to inaugurate the work. If any better, any broader, plan be offered, the writer will bend every energy to put it in force. There are, of course, interests now thriving on the free use of these areas which, for selfish reasons, will oppose any measure looking to staying the destruction by which they profit; yet, if our civilization is to stand — if this great commonwealth is to advance with the advancing ages, this devastation must cease; systematic and economic use of this wealth must take the place of the methods now in vogue. History and nature record no law more inflexible — no effect more certain — than that poverty and degradation follow upon the destruction of mountain forests.

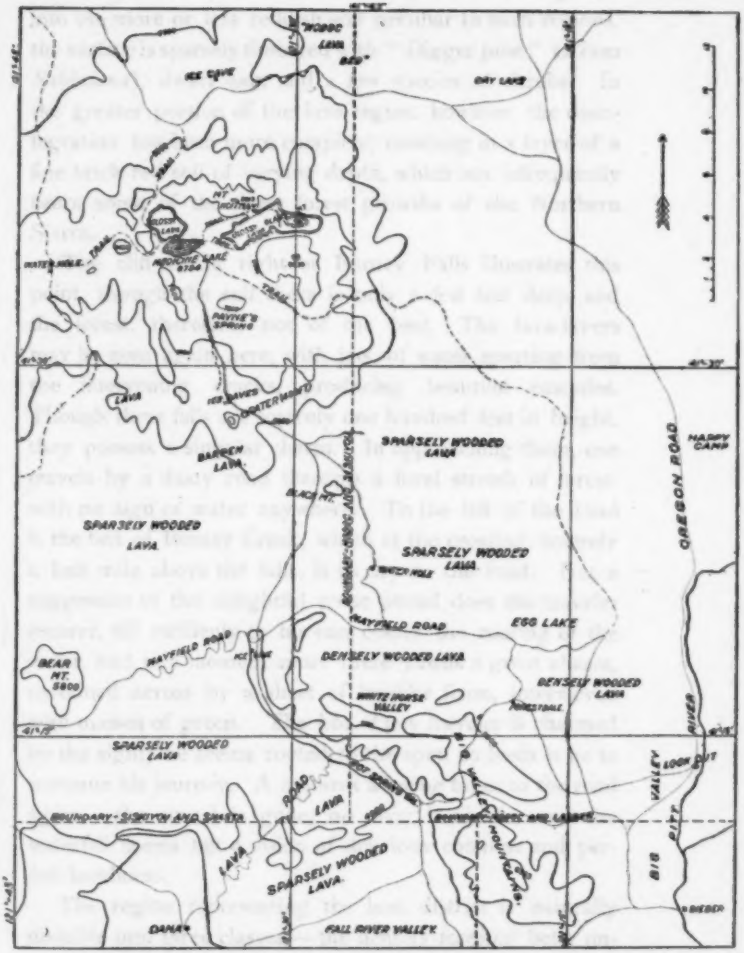
THE LAVA REGION OF NORTHERN CALIFORNIA.

By M. S. Baker.

The Lava Region of Northern California is usually known as the "Modoc Lava-Beds," a name which is probably due to the prominence given a small area of the lava-beds in Modoc County at the time of the Modoc War. It is, however, a misnomer,—the greater area being in Siskiyou County, as shown by the accompanying map. Even the map shows only a small part of the vast lava-field which stretches westward to Mt. Shasta, northward through Oregon and Washington into British Columbia, and eastward into Nevada, Idaho, and Montana. According to Le Conte, this is one of the largest lava-fields in the world, covering an area of not less than 150,000 square miles, with an extreme observed thickness of 4,000 feet in the Columbia River Cañon.

In the regions I have visited, I know of but one deep cut into the underlying lava—the Pitt River Cañon in Shasta County, between Burney Valley and Fall River Valley. This is not shown on the map, but has probably been seen by some of the readers of the Sierra Bulletin, as the stage-road from Redding to Alturas passes along the bed of the cañon. A view of the right-hand cliff is shown in the photograph. This is a sheer precipice of about 700 feet, and is composed of almost countless layers of lava, each of them representing, apparently, a distinct lava flow. It, however, does not represent the entire depth at this point, as the river-bed is still lava.

Near the sky-line of the same photograph may be seen some scattered trees, which illustrate to some extent the



MAP OF THE LAVA REGION SURROUNDING MEDICINE LAKE, SISKIYOU CO.

(Lines in black mark 1000-ft. levels, traced roughly from "Modoc Lava Bed Sheet" of U. S. Geological Survey. Unbroken lines in red are wagon-roads, and broken red lines, trails. Many of these are from memory, and accurate only as to general direction.)

surface appearance of a portion of the lava region. Covered with fragments of basalt or lava, which has disintegrated into the more or less reddish soil peculiar to such regions, the surface is sparsely timbered with "Digger pine" (*Pinus Sabiniana*), dwarf oak, and a few species of shrubs. In the greater portion of the lava region, however, the disintegration has been more complete, resulting in a layer of a fine brick-red soil of varying depth, which not infrequently bears some of the finest forest growths of the Northern Sierra.

The cliff at the right of Burney Falls illustrates this point, though the soil there is only a few feet deep, and the forest, therefore, not of the best. The lava-layers may be seen again here, with jets of water spurting from the intervening cracks, producing beautiful cascades. Though these falls are scarcely one hundred feet in height, they possess a singular charm. In approaching them, one travels by a dusty road through a level stretch of forest, with no sign of water anywhere. To the left of the road is the bed of Burney Creek, which at the crossing, scarcely a half mile above the falls, is as dry as the road. Not a suggestion of the delightful scene ahead does the traveler receive, till suddenly to his ears comes the roaring of the water, and in a moment more there yawns a great chasm, curtained across by a sheet of lacelike foam, interwoven with masses of green. The hot, dusty traveler is charmed by the sight; he seems rooted to the spot, so loath is he to continue his journey. A moment after he takes to the road again,—the sound is gone, no river is visible, and the waterfall seems but a vision of delicious coolness and perfect loveliness.

The region representing the lava district is naturally divisible into three classes,—the densely-forested belts underlaid by lava, already referred to, the sparsely-timbered portions, as in the Pitt River region, and the barren lavas.

The second and third classes are familiarly known as "Lava-Beds," particularly the second class, as that is by far the most common. The only completely barren lava that I have seen is in the Medicine Lake region, and the only other I know of is to the north of Lassen Peak.

The forested and sparsely-timbered region of lava, however, covers most of the Northeastern Sierra between Mt. Lassen and Shasta, and to the north and east, in an almost unbroken field. Scattered patches and streams of lava have been found far to the south, especially in the Higher Sierra, where in many places the old cañons are filled with lava, which sometimes extends on the west almost to the valley floor.

An idea of the sparsely-timbered class of lavas may be obtained from the foreground of the picture showing "A Cypress of the Lava," though the surface is usually more broken. The many small, irregular cracks seen in this view are due to the cooling of the lava. In many places, in addition to these crevices, which are always quite small, depressions known as "pot-holes" occur, varying from a few feet to a hundred feet in diameter, and from a foot to twenty feet in depth. Their surfaces are far from smooth, appearing nearly as broken as the barren lava shown in the picture of Glass Mountain.

These pot-holes are supposed to be due to the formation of cavities during the cooling of the lava, and the subsequent falling in of their roofs. A crust soon forms on the molten mass, and in many places the lava underneath flows on, leaving cavities of varying sizes. The confusion caused by the falling in of the covers of these huge blisters is indescribable. As the lava becomes older, the holes fill up, and gradually the surface becomes covered with timber and more nearly level, till the entire surface is covered with soil, which bears a heavy forest.

The foreground of the photograph of the cinder-cone

BURNEY FALLS, SHASTA COUNTY.
From a photograph by M. S. Baker, July, 1898.

A CYPRESS OF THE LAVA, NORTHWESTERN SHASTA COUNTY
From a photograph by M. S. Baker, August, 1898.

(Medicine Lake) is another view of the barren lavas. A larger view of this barren region is obtained from the top of the cone. The cone is really a crater from which has flowed much, if not all, of the lava in the field. It is near the northern limit of the field, which slopes by a very steep incline to the south and west, a distance of six or seven miles, I judge, though I have not been over it. This flow I found of the greatest interest, since it represents, in miniature form, the characteristics of the larger and older flows, without their covering of soil and forest growth. Here is a small lava-field, with its crater, which was formed only as yesterday, and all in the compact area of perhaps ten square miles! There is scarcely a spear of grass, or any other vegetation, to be found upon its surface. It is a blackened region of desolation, awakening in the observer much the same sensation as does a vast fire-swept area; a desolation the more marked because of the green wall bounding it on all sides.

Except on the tops of the few peaks which escaped complete burial, there is nothing left of the forest that once covered the region. All else must have been swept down and completely hidden from sight. One of the green island peaks is shown in the view to the south of the crater. Something of the roughness and the incline of the lava is also indicated here.

Of the date of this eruption, I have little evidence, since the United States Geological Survey has not yet published a report of the region. But that it is comparatively recent is evidenced by the almost entire lack of vegetation, while the older lava surrounding it is quite densely covered in places with forest and underbrush. The island peaks, also, are doubtless composed of lava, or basalt, of a much earlier time. The view of the cinder-cone shows three or four pines in the foreground, while the cone itself has quite a sprinkling of forest growth,

due to the softer nature of its sides, much of it being pumice-stone.

In all, I observed scarcely a dozen species of plants in crossing a stretch of perhaps a half mile of lava, and in climbing and exploring the crater. The pioneer plants which are the most efficient reclaimers of the barrenness appear to be two species of pine, the mountain pine (*Pinus monticola*) and the tamarack-pine (*Pinus Murrayana*). How these poor contorted dwarfs are able to live with their roots in the crevices of bare rock it is difficult to see. They illustrate something of the relative importance of atmosphere and soil to the life of the trees. Notwithstanding their scrubbiness, however, I saw many cones lying about. The trees in the foreground of the crater are mountain pines. The appearance of the tamarack-pine in a similar region about Glass Mountain is shown in the photograph of the mountain from a distance. The growth seen here is exclusively tamarack, growing in the pumice that fills up the depressions in the lava.

Mr. J. S. Diller, of the Geological Survey, has made a study of a very similar lava flow of recent date in the vicinity of Lassen Peak. It is probably even more recent than the one I speak of, for the charred trunks of some of the trees killed by the flow are still standing *in situ*. Many of the trees on the cinder-cone of the Medicine Lake lava must be at least three or four hundred years old. A complete exploration of this field would be of great interest in illustrating how the older lavas were formed, and in determining the extent and age of this one.

At a distance of about ten miles to the north of the cinder-cone is the Medicine Lake region, celebrated locally for its game, for a mountain of pure volcanic glass, and for a beautiful sheet of clear, pure water. The lake is approximately two miles in length by one in width. It has no outlet, and scarcely any water supply save from the melting of

MEDICINE LAKE -- FROM THE BLUFF AT THE SOUTHWEST.
From a photograph by M. S. Baker, August, 1898.

GLASS MOUNTAIN - FROM A DISTANCE.
From a photograph by M. S. Baker, August, 1898.

the snow. Yet, in the driest years, I have never known the lake to be contracted much under the dimensions given. The appearance of the lake from a bluff to the southwest is shown in an accompanying photograph. In the distance may be seen Mt. Hoffman, one of the highest peaks of the region (8,018 feet). At the extreme right of the view is a small elevation; this is Glass Mountain, four or five miles to the east. This mountain, if such it may be called, is only 600 feet above the surrounding country at its highest point, while most of its surface is but 200 to 400 feet high. Though not remarkable in height, it certainly is in character. By an examination of the map, it will be seen that a flat-topped area of some five miles, by a mile and a half in extent, is marked off to the east of the lake by the 7,000-foot contour line. Just inside this line the 200-foot level is drawn as close as possible to the 7,000-foot line, representing a cliff of 200 feet. The whole inclosed area is made up of the roughest lava imaginable, sparsely timbered by the pines already mentioned, which are shown in the foreground of the view of Glass Mountain.

All the lava in this area is of a glassy nature; but no pure obsidian was seen till I reached the base of the mountain, where it may be picked up in abundance. Large bowlders of it, of much the same color as flint, lay about, and the side of the cliff glistened with the broken fragments. On the eastern side of the mountain, I am told, the glass is not wholly black, but beautifully banded with a brick-red. Most of it seemed to come from a layer below the top surface, as I found scarcely any on the top, though all of the lava was glassy. The banded appearance of the broken surfaces showing the flow may be seen in many of the fragments.

A more rugged, topsy-turvy pile of rocks than the top of Glass Mountain can scarcely be conceived. I tied my

horse at the base of the cliff, with the intention of going to the top, but before I proceeded far, it became evident that I must give it up, or come back barefooted, so severe is the glassy lava upon shoe-leather. As it was, it required the most of one afternoon for repairs.

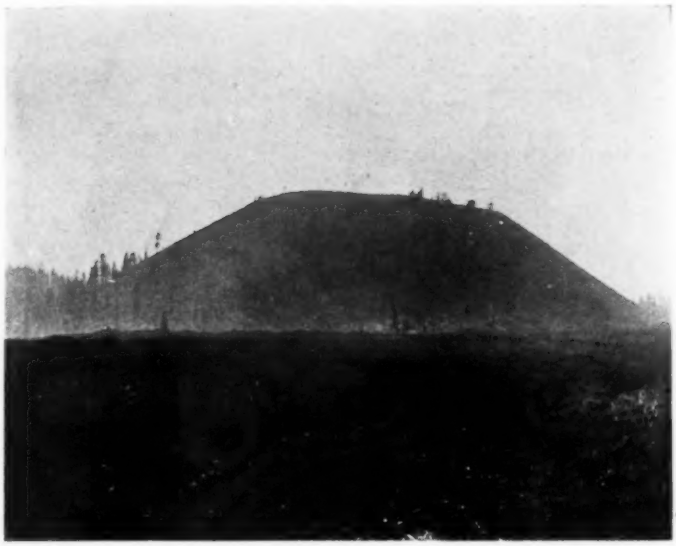
Another area of glassy lava, directly north of the lake, and similar to the area upon which Glass Mountain rests, is represented on the map by double contour lines 200 feet apart. Neither of these areas appears to be a flow, as neither is connected with a higher level, yet I could find no sign of a crater.

Two other objects of interest to our party were the beautiful trees of hemlock-spruce, growing on the peaks to the west of the lake, and the fine view of Mt. Shasta from the top of these peaks. The mountain is about thirty miles to the southwest, but even at that distance appears immense, on account of the altitude of the observer, and also because Shastina is hidden behind the main peak, giving the appearance of greater height because of the narrowed base.

One other feature of the lava region must be mentioned — the ice-caves. There are several of these known, and very likely many more remain undiscovered. Those located along the edge of the lava, near the cinder-cone, I have known to contain ice and water as late as August. The largest I have seen is on the Mayfield road, about twenty miles east of Bartles. It is situated in the barren lava, and in one of the warmest localities of the region,— and there are few cool spots in the lava anywhere. One enters the cave by crawling down a hole none too large. The instant the interior is reached the temperature falls in a surprising way. Not more than ten feet below the surface of the hot rocks is a bed of ice, covered by a foot or so of ice-water. The body of ice was perhaps twelve or fifteen feet long, by five feet across in the widest places. This cave is formed by a fissure that extends a distance of

THE SUMMIT OF GLASS MOUNTAIN.
From a photograph by M. S. Baker, August, 1898.

PITT RIVER CAÑON, SHASTA COUNTY.
From a photograph by M. S. Baker, July, 1898.



CINDER-CONE (OR CRATER), SISKIYOU COUNTY.
From a photograph by M. S. Baker, August, 1898.

THE RECENT LAVA-FLOW FROM THE CRATER OF THE CINDER CONE.
From a photograph by M. S. Baker, August, 1898.

twenty miles from the ice-cave to Pittville, and nearly coincides with the 4,000-foot level, as shown in the map. Along the southeastern half of this earth-fissure the southwest wall has faulted, leaving a cliff, which, in places, must be nearly 200 feet high.

For varied and awe-inspiring scenes, the Northeastern Sierra does not compare with the Central and Southern. Generally speaking, there is little beauty of scenery to be found except in favored localities. The ever-present forests of high conifers on the peaks almost entirely prevent the magnificent outlooks so common toward the south. The peaks are of only moderate height, and lack the rugged precipitousness of those about Tahoe, Yosemite, and Mt. Whitney. But the loss in scenery is partly compensated by the comfort in traveling (except over the lava-beds, which one may well pray to be delivered from), and by the almost endless shade of the cool forests.

FORESTRY NOTES.

Edited by Professor WILLIAM R. DUDLEY.

A new National Park was created by Act of Congress and the approval of the President, March 2, 1899. It is to be called *The Mount Rainier National Park.* It is eighteen miles square, with Mount Rainier for its center, and formerly was a part of the Pacific Forest Reserve, established February 20, 1893. This reserve, now known as the Mount Rainier Forest Reserve, was extended south to the Columbia in 1897, and is joined on the north by the Washington Forest Reserve. In the *Forester* for May, 1899, Bailey Willis, of the United States Geological Survey, gives a map and an extremely good account of this important new park, and advocates its extension in certain directions, to include forests, glaciers, and adjacent spurs that naturally belong to this park. It appears that two eminent Europeans, Professor Karl Zittel, the geologist, of Munich, and the Hon. James Bryce, who is a member of the English Alpine Club and an ardent mountaineer, wrote a joint letter in 1883, saying, "The combination of ice scenery with woodland scenery of the grandest type, is to be found nowhere in the Old World, unless it be in the Himalayas, and, so far as we know, nowhere else on the American Continent." They then expressed a hope that Congress would include the peak in a National Park.

Some twelve years or more passed, when "a memorial, prepared by a committee representing the American Association for the Advancement of Science, the Geological Society of America, the Sierra Club of California, and the Appalachian Mountain Club, was presented to the Senate by Senator Squire of Washington. In 1897, a bill based on this memorial, and designed to establish a National Park, passed both Houses of Congress, but failed of signature by the President." This bill, with slight modifications, was again introduced in 1899, and became a law. This park is placed under the control of the Secretary of the Interior, whose duty it is to police it and protect its woods, fish, and game. Mr. Willis says the main divide of the Cascades lies twelve miles east of Rainier's summit, and possesses a nearly even crest of 5,000 to 6,500 feet elevation. He suggests the construction of a road along this for fifty miles from the Northern Pacific Railroad south to the southern side of the park. "This splendid snow-peak would be seen rising from cañons far below this road to a height of 8,000

feet above it. That it is practicable to lay out this road there is no doubt, and that it will be found profitable, and will be built, is more than probable. It will challenge the world for its equal in variety and majesty of scenery."

The smallest of the California forest reserves received an accession of 50,000 acres through the proclamation of President McKinley dated January 30, 1899. This tract, known as the Trabuco Cañon Forest Reserve, now contains 99,920 acres. The original reservation was made February 25, 1893.

Under the date of February 10th, the Fish Lake Reserve,— a mountainous tract of 67,480 acres about Fish Lake and Fremont Valley, Utah, and south of the middle of the State,— was established by executive proclamation.

Under the same date, the Gallatin Forest Reserves, in Montana, were created. They consist of a series of even-numbered sections of mountain forest near Bozeman, within the watershed of the Gallatin River, and aggregate 40,320 acres. The alternate sections are railroad land.

On March 4th of the current year, the Gila River Forest Reserve was established. It is in New Mexico, and adjoins the Black Mesa Forest Reserve of Eastern Arizona. Its center seems to be the Mogollon Mountains, and it includes several of the sources of the Gila River, whose fertile lower valley is such an important part of Arizona. As this fertility, because of the aridity of climate, depends upon irrigation, the importance of the range of forest reserves recently created through central Arizona and New Mexico, cannot be easily overestimated.

In the telegraphic dispatches of April 14th, the President is reported to have set apart 136,000 acres, as the long-contemplated *Lake Tahoe Forest Reserve*. It covers something like nine townships in the mountain region southwest of Lake Tahoe, and has Pyramid Peak for its approximate center. As in all the forest reservations, lands on which entries have been made,— and there are many such near the western shore of Lake Tahoe,— are excepted from the reserve. Practically the entire forest belt of Government land in the Sierra Nevada Mountains, from Mount Breckenridge, east of Bakersfield, to the southwestern shore of Lake Tahoe, a distance of nearly 250 miles, is now reserved. This contains the sources of the Kern, the Tule, the Kaweah, the King's, the San Joaquin, Merced, Tuolumne, Stanislaus, Moquelumne, and American rivers, which rise among peaks from 10,000 to 14,000 feet elevation, and flow down into the great fertile but semi-arid plain known as the San Joaquin and Lower Sacramento valleys. To these abundant resources of irrigation might be added the many secondary and minor streams from the Fresno

and Calaveras rivers down to the foothill creeks, which could be counted on, if necessary, for storage water. This plain, averaging but a few hundred feet above sea-level, capable of producing all the stone fruits and small fruits, and in places the orange, lemon, and fig, is not less than 7,000,000 acres in extent, and is surrounded by great tracts of foothills suitable for olive and grape culture in the lower levels, and the pomaceous fruits at moderate elevations. Surrounding this plain, and from a few hundred to a few thousand feet above it, is the long-known, and still rich, mineral belt. In carefully considering other sections of our country, it does not appear that any other, of anything like this extent, presents such a favorable combination of natural advantages, or could support such a large number of people, if rightly cared for. A vast productive plain; a climate favorable to all the fruits of temperate and sub-tropical regions; proximity to a large bay and seaport; large mineral deposits; lofty mountains covered by coniferous forests, which, by care and renewal, can be made to yield a sufficient supply of fuel and lumber, and will afford protection to the abundant water supply, derived from the complete annual melting of a heavy snowfall; such are the conditions setting apart Central California as one of the most important natural districts in America to which the best results of science in forestry and the conservation of waters ought, at an early day, to be applied.

A consistent policy toward our forests in the semi-arid regions has for some years been apparent. Beginning with the recommendations of its Forestry Commission, and since the agitation of the question in 1897, it has clearly been the aim of the United States Government to reserve those mountain forests in California, Arizona, New Mexico, and Utah which protect the water supplies of the fertile valleys below. That is the significance of the belt of reservations almost encircling the orange-growing district in Southern California. That is also what the successive reservations in the Sierra, now nearly continuous from Breckenridge to Tallac, signify in relation to the great plain of Central California. The Sierra Forest Reserve, great as it is, is by no means complete. An extension of this to the Pitt River, Shasta, and the Upper Sacramento, or at least over so much of this region as shall include the head-waters and forests of the streams descending into the Sacramento Valley, is but the logical conclusion of this policy in relation to California. The BULLETIN has before advocated this; and a year ago the San Francisco Board of Trade petitioned the Government to establish a forest reservation about Lassen Butte.

Instead of applying the "German system" to our forests, or devising an "American system" out of hand, to be applied to the whole country, we must recognize that our country is so great, and includes such extremes of humidity, and totally different manifestations of temperature, that we must devise a California system of forestry, a Great Basin system (although the two will have much in common), and a Northwest Forest system, differing probably from the Alleghanian. Most certainly we must first recognize the fact that we have within our national borders an arid region, without excessive cold or destructive hurricanes, but where the lifelong dread of the tiller of the soil concerns a lack of water; another, a humid region, with abundant rainfall, where the excessive winter cold is most to be feared. In the first, our chief care must be to keep an unbroken forest cover over the mountain areas down to the lower limits of the winter snow; also to prevent over-pasturage. The question of lumber and fuel are secondary, that of revenue from the forests is incidental. In the second, because of abundant rainfall, of easy, natural renewal of the forested areas, and of cold, the questions of cheap and abundant fuel, of lumber, and of revenue from the same, become of first importance to the country; and the question of water supply (as for cities and mines), though important, is incidental. Both of these problems, curiously enough, occur within our own State. Yet Northwestern California, where the water-supply question is secondary, and the timber interests are highly important, will require a forest management different from any section of the Eastern United States. The forestry of the central Coast Range of California, and that of the mountains of the southeastern desert region are not pressing questions; but two great natural divisions of the State, each, economically, of the highest importance, each requiring special study and its own elaborate system of forest treatment, and of reservoirs, each made ready for such study by the nearly complete series of forest reservations, do require immediate attention. These are the great central valley and Southern California, both coming under the first class of problems mentioned. Localizing preliminary forestry study in this manner appears to be inevitable. The study of local conditions, interpreted scientifically, will result in the growth of individual systems adapted to sections where they have originated; and this method is bound to give the whole country a sound and economical forest management. As there are no richer areas in the drier regions of the United States than the two California districts, we invite the Government to send experts to them at once for the purpose of reporting a plan of forest management for Central California and Southern California, at an early date.

Meanwhile these timber reservations are to be protected from fires, timber thieves, and irresponsible shepherds another season by means of the "rangers." We desire to reaffirm our former words of commendation for the rangers appointed from the foothills or mountains they are to guard. They have the advantage of a complete knowledge of the mountain passes and trails, and they are usually among the most faithful of men. So far as observation went last fall, the late appointments were from this class, and consequently their work was well done. Our criticisms in the January BULLETIN applied only to the appointment — chiefly the earlier ones — of men who knew nothing of the mountains. This criticism — resorted to by a considerable number of journals — we regret, for it appears that the inefficient and ignorant men were replaced by better ones, as soon as practicable.

THE CALIFORNIA WATER AND FOREST SOCIETY.

The organization of the California Water and Forest Society, in January of this year, was due directly to the object-lesson given the industries of this State by the mountain fires and drought of 1898. The Miners' Association took the initiative, and through a special committee, called a meeting of those interested in the "conservation of the water and the preservation of the forests." Representatives of the mining, agricultural, horticultural, and commercial interests from all parts of the State met in San Francisco, and after discussing the objects of the meeting, adopted a permanent organization under the control of an executive committee, which will act under standing sub-committees. The foundation was thus laid of an organization which may be of incalculable benefit to the State. Its success will depend upon a large membership and an active executive committee.

Immediately after organization, some work was undertaken by the committee on legislation. This committee went to Sacramento in the hope of urging the Governor to recommend to the Legislature the passage of two measures,—one having as its object the co-operation by the State with the United States Geological Survey in reporting upon the places and methods for storing waters in the mountains, and the other asking that an unsalaried commission be created to report upon the forests of the State, and that a department of forestry be organized at once at the University of California to supply men prepared to carry out the suggestions of the commission. The bill relating to water-storage failed to reach the Governor in time for his signature; that relating to forestry did not reach final passage in the Legislature. The

organization of a forestry department in the University was not included in the proposed legislation, owing to objections raised by the Governor.

That this legislation failed is to be regretted. The State of Colorado has obtained a valuable and practical report by the United States Government upon her water supplies; the State of Wisconsin, through the agency of an unsalaried forestry commission, created by the Legislature in 1897, had her forests studied and reported on by a special agent of the Division of Forestry of the U. S. Department of Agriculture (Bulletin No. 16); the State of Oregon had a similar inspection and report made in 1897 of "Forest Growth and Sheep-Grazing" by an agent of the same department (Bulletin No. 15). The legislation proposed had in view similar results, to be obtained by enlisting the services of the Departments in Washington. But most to be envied is the State of New York, whose Legislature has established a college of forestry at Cornell University. Let us hope that the authorities of our universities will not overlook the ranking importance of the subject, and will follow Cornell's lead.

The scope of work of the California Water and Forest Society therefore is clearly defined, but its problems are many and difficult. More rational lumbering methods, protection of the forests from fire, the storage of the flood-waters, their proper distribution, are all questions that will require careful and continued investigation.

The society's first great duty will be to teach the people of the State the truth of the Arabian proverb, adopted as its motto, "The Tree is the Mother of the Fountain."

ELLIOTT MCALLISTER.

May 16, 1899.

NOTES.

In addition to longer articles suitable for the body of the magazine, the editor would be glad to receive brief memoranda of all noteworthy trips or explorations, together with brief comment and suggestion on any topics of general interest to the Club.

The office of the Sierra Club has been moved to Room 45, Merchants' Exchange Building, San Francisco, where all the maps, photographs and other records of the Club now are.

The maps of the Yosemite and San Joaquin Regions by J. N. Le Conte, may be had by members of the Club upon application and payment at the Cottage in the Yosemite Valley.

The attention of the members is again drawn to the few copies on file of No. 3, Volume I, of the BULLETIN. *Those who have any extra copies of this number, will kindly send them at once to the Secretary.*

SECRETARY'S REPORT.

FROM MAY 1, 1898, TO APRIL 30, 1899.

The membership of the Club during the year 1898 to 1899 has remained about the same, the accessions being about equal to the losses resulting from resignations and non-payment of dues.

The Headquarters in Yosemite Valley have been continued this year, and they promise to be of great interest and value to the members of the Club and others visiting the valley.

The following have been elected Directors and officers for the year 1899–1900: —

MR. JOHN MUIR . . . . . *President.*
MR. ELLIOTT MCALLISTER . *Vice-President.*
MR. J. N. LE CONTE . . . . *Treasurer.*
PROF. W. R. DUDLEY . . . *Corresponding Secretary.*
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PRES. DAVID STARR JORDAN,
MR. WARREN OLNEY,
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PROF. CLARENCE L. CORY.

COMMITTEE ON PARKS AND RESERVATIONS.

PRES. DAVID STARR JORDAN, *Chairman,*
MR. WARREN OLNEY, PROF. JOSEPH LE CONTE,
MR. ABBOT KINNEY, MR. CHARLES A. BAILEY.

The other standing committees of the Board will be reported to the members later on.

Amount of cash on hand May 1, 1898	$ 29 45
Total collected for dues for the year	520 00
Received from sale of publications	40 35
Received on account Yosemite Headquarters	56 00
Total	$645 80
Cash deposited to account of Treasurer	$641 60
Balance cash on hand	4 20
Total	$645 80

Respectfully submitted,

ROBERT M. PRICE,
Secretary.

REPORT OF TREASURER OF SIERRA CLUB.

MAY 1, 1898, TO APRIL 30, 1899.

RECEIPTS.

Balance from former Treasurer	$ 49 59
Cash received from Secretary	641 60
Cash received — unexpended balance from Yosemite Headquarters	24 10
	$715 29

EXPENDITURES.

Printing and mailing SIERRA CLUB BULLETIN	$324 85
Printing circulars, etc.	17 25
Telegrams, and mailing circulars	10 60
Postage and sundry expenses of Secretary's office	7 04
Express charges for moving	6 00
Public meeting	11 50
Room rent — 17 months	140 00
Clerical service	62 00
Yosemite Headquarters	90 00
	$669 24
Balance on hand	46 05
	$715 29

C. B. BRADLEY,
Treasurer.

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PUBLICATIONS OF THE SIERRA CLUB

Number 19

SIERRA CLUB BULLETIN

Vol. II No. 6

JUNE, 1899

SAN FRANCISCO, CAL.
1899

SIERRA CLUB BULLETIN

JUNE, 1899

Vol. II No. 6

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FORESTRY NOTES: Some Recent Forest Reserves — Additions to Forest Reservations in California — Forest Management for California — The California Water and Forest Society.

Secretary's Report — May 1, 1898, to April 30, 1899.

Treasurer's Report — May 1, 1898, to April 30, 1899.

All communications intended for publication by the SIERRA CLUB, and all correspondence concerning such publication, should be addressed to the Editor, Warren Gregory, 222 Sansome Street, San Francisco, California.

Correspondence concerning the distribution and sale of the publications of the Club, and concerning its business generally, should be addressed to the Secretary of the Sierra Club, Merchants' Exchange Building, San Francisco, California.

PUBLICATIONS OF THE SIERRA CLUB

No. 1.—Articles of Association, By-Laws, and List of Members.

Nos. 4 and 5.—Maps of Portions of the Sierra Nevada adjacent to the Yosemite and to King's River, 1893.

No. 8.—Table of Elevations within the Pacific Coast, 1895, by Mark B. Kerr and R. H. Chapman. *Price, 25 cents.*

No. 12.—Map of the Sierra Region, May, 1896. *Price, $1.50.*
To be had of Theodore S. Solomons, 508 California Street, San Francisco, California.

Nos. 2, 3, 6, 7, 9, 10, 11, 13, together forming Volume I. of the SIERRA CLUB BULLETIN.

Contents of Volume I.—Ascent of Mt. Le Conte; Address on Sierra Forest Reservation; California Outing; Crater Lake, Oregon; Diamond Hitch; Explorations North of Tuolumne River; Forest Reservations; From Fresno to Mt. Whitney, via Roaring River; From Gentry's to El Capitan and Yosemite Falls; Grand Cañon of the Tuolumne; Head-waters of King's River; Kern and King's River Divide; King's River and Mt. Whitney Trails; Knapsack Tours in the Sierra; Mt. Bernard; Mt. Tahoma; Mt. Whitney Trail; New Grove of Sequoia Gigantea; Notes on the Pine Ridge Trail; Route up Mt. Williamson; Search for a Route from the Yosemite to the King's River Cañon; Sources of the San Joaquin; Three Days with Mt. King; Through Death Valley; Through the Tuolumne Cañon; Tramp to Mt. Lyell; Upper Sacramento in October; Notes; Correspondence, and Reports.

On receipt, in good condition, of a full set of the numbers comprising Volumes I or II, together with the sum of $1.10, a bound volume will be forwarded, postpaid.

Nos. 14, 15, 16, 17, 18 and 19, together forming Volume II. of the SIERRA CLUB BULLETIN.

For table of contents see the last pages within.
Each number, 25 cents.

Copies of the above publications may be had on application to the Secretary, Merchants' Exchange Building, San Francisco, Cal.

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